US006093112A

United States Patent [19]

Peters et al.

[11] Patent Number: 6,093,112

[45] Date of Patent: Jul. 25, 2000

[54] **CORRELATED SET OF GOLF CLUBS**

[75] Inventors: **Michael R. Peters**, Vista; **Richard L. Rugge**, Encinitas; **Bret Wahl**, Carlsbad, all of Calif.

[73] Assignee: **Taylor Made Golf Company, Inc.**, Carlsbad, Calif.

[21] Appl. No.: **09/021,024**

[22] Filed: **Feb. 9, 1998**

[51] **Int. Cl.**[7] **A63B 53/04**

[52] **U.S. Cl.** **473/291**; 473/350

[58] **Field of Search** 473/287–291

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,655,188	4/1972	Solheim .	
3,984,103	10/1976	Nix	473/291
4,147,349	4/1979	Jeghers	473/291
4,645,207	2/1987	Teramoto et al. .	
4,715,601	12/1987	Lamanna .	
4,802,672	2/1989	Long .	
5,154,377	10/1992	Suk	248/96
5,160,136	11/1992	Eger .	
5,261,663	11/1993	Anderson	473/342
5,333,872	8/1994	Manning et al. .	
5,380,004	1/1995	Teramoto	473/291
5,388,826	2/1995	Sherwood .	
5,413,336	5/1995	Iwanaga .	
5,423,535	6/1995	Shaw	473/291
5,480,145	1/1996	Sherwood .	
5,547,194	8/1996	Aizawa	473/350
5,658,209	8/1997	Blakemore .	
5,665,009	9/1997	Sherwood .	
5,665,014	9/1997	Sanford	473/345
5,669,825	9/1997	Shira .	
5,722,900	3/1998	Sung	473/291
5,833,551	11/1998	Vincent et al.	473/350
5,921,869	7/1999	Blough et al. .	

FOREIGN PATENT DOCUMENTS

0 517 487 A1	2/1992	European Pat. Off. .
304 5407	11/1997	Japan .
2 316 011	6/1997	United Kingdom .

OTHER PUBLICATIONS

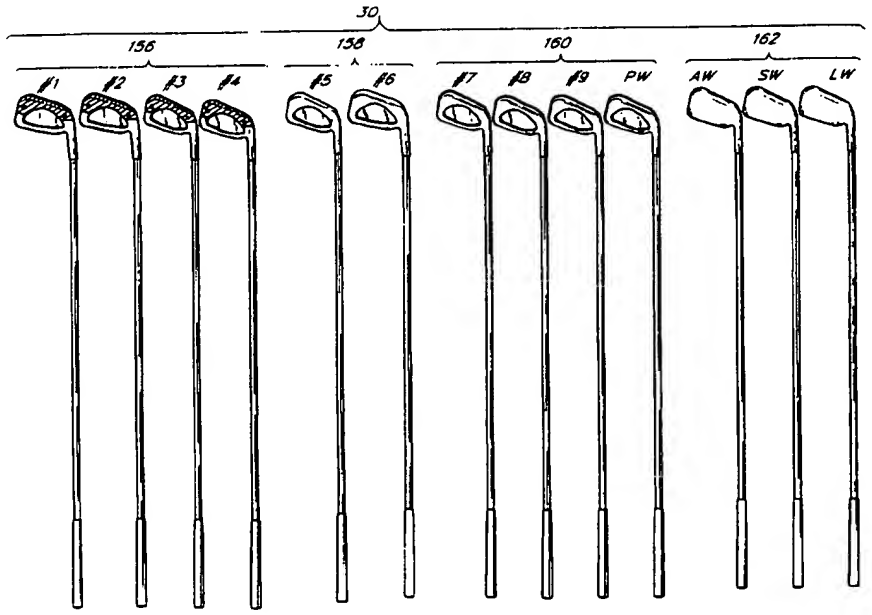
The Club Scene, Golf Shop Operations (G50), p. 29, Jan. 1998.
Earlyfield Advertisement, 1 page.
Browning 440 Woods Irons (Advertisement Sep. 1976 Golf Digest).
ENA 1998 Collection (Brochure from Feb. 1998 PGA Show in Japan, pp. Cover, 11 & 12).
Nicklaus 1998 Product Catalog (PGA Show in Orlando Jan. 30–Feb. 2, 1998).
Taylor Made Jan. 1997 Brochure.
FX Pro–Set Brochure form Jan. 1997 PGA Show.

Primary Examiner—Jeanette Chapman
Assistant Examiner—Stephen L. Blau
Attorney, Agent, or Firm—Knobbe, Martens, Olson & Bear, LLP

[57] **ABSTRACT**

Disclosed is a set of golf clubs. The clubs are divided into at least a first group and at least a second group of golf clubs. The first group desirably comprises a plurality of club heads each having a main body of low density metallic material. The second group of golf clubs desirably comprises a plurality of club heads each having a main body of higher density metallic material than the density of the metallic material of the main body of each of the heads of the first group. The first group of clubs desirably comprises lower numbered clubs than the second group of clubs.

7 Claims, 12 Drawing Sheets



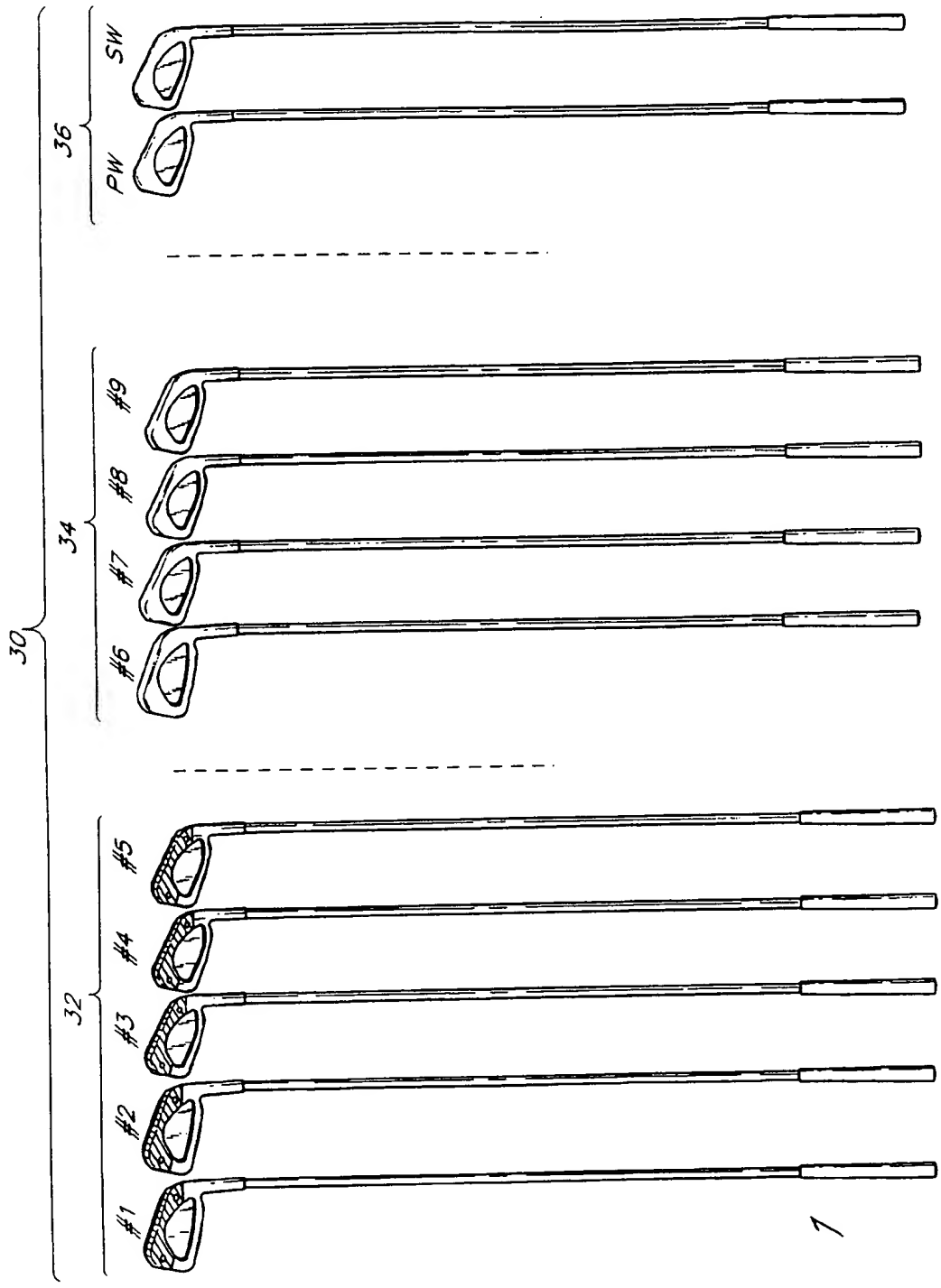


FIG. 1

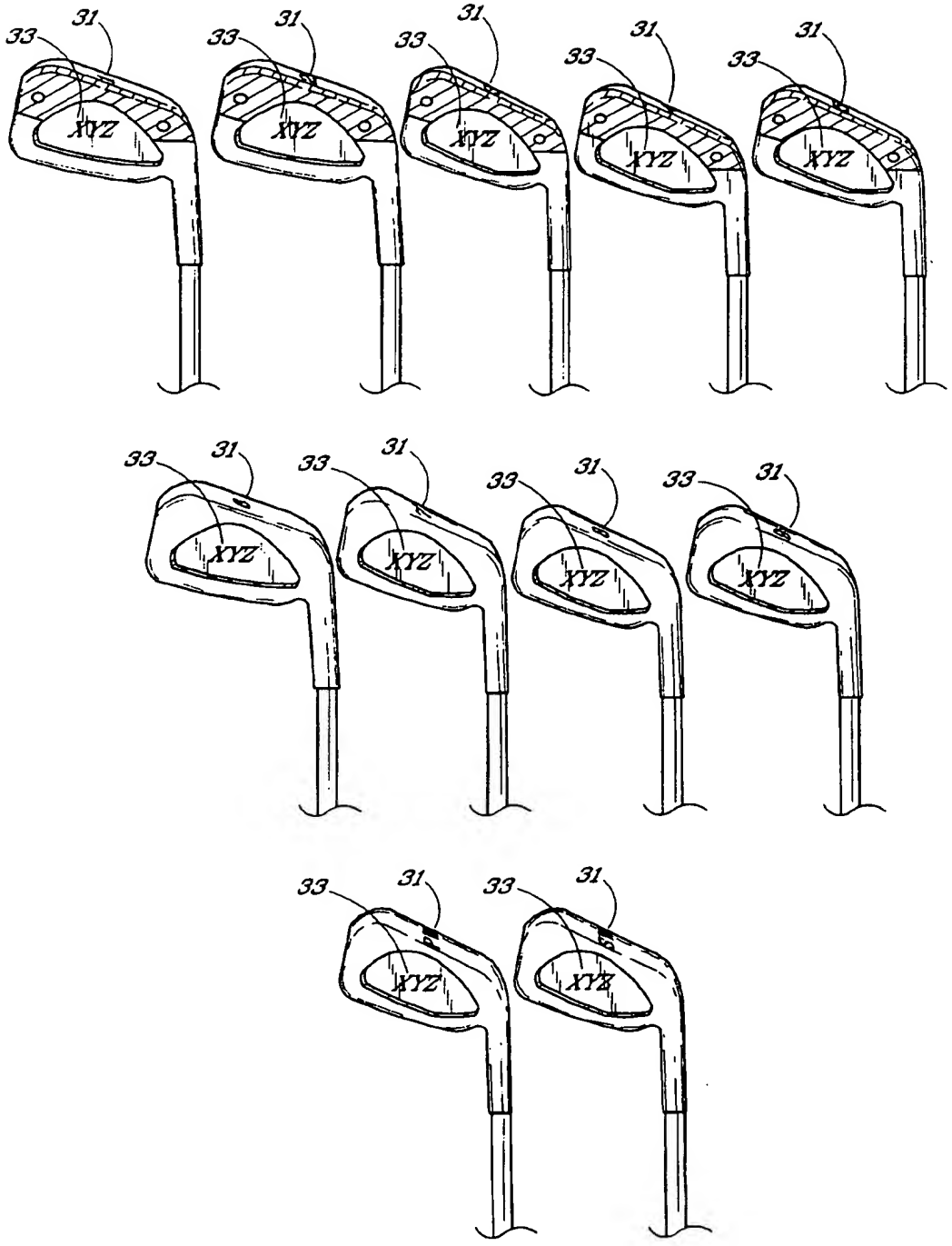


FIG. 1a

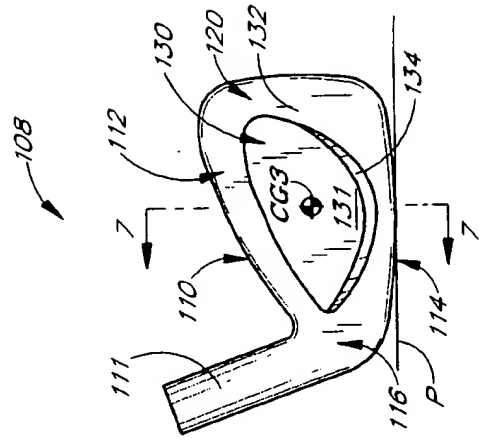


FIG. 6

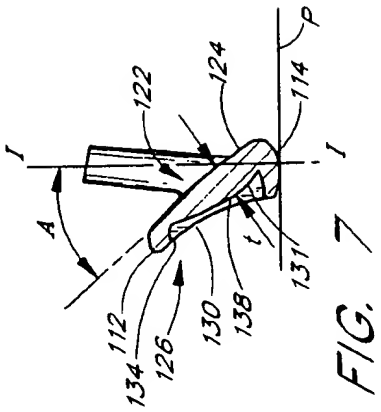


FIG. 7

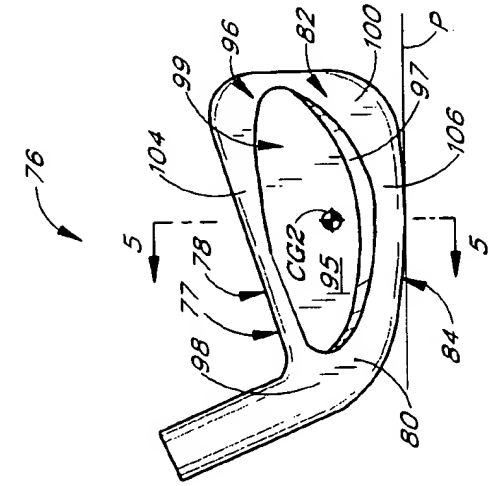


FIG. 4

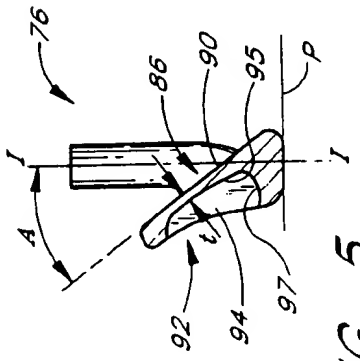


FIG. 5

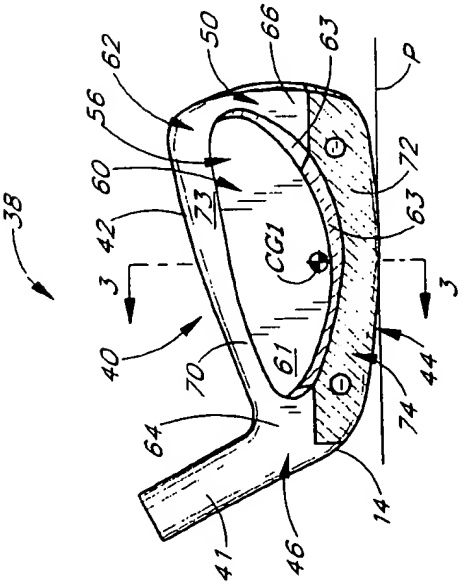


FIG. 2

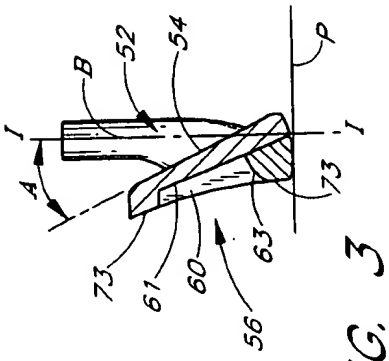


FIG. 3

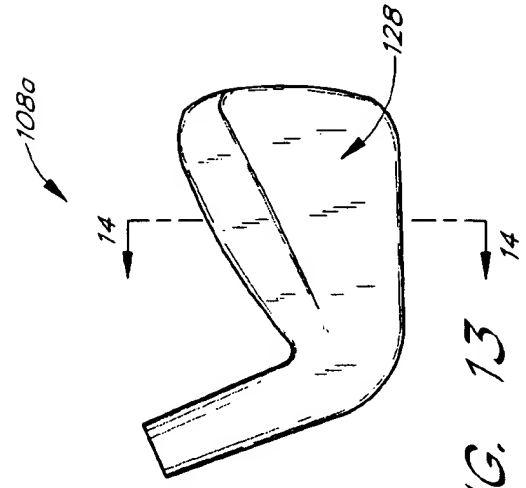


FIG. 13

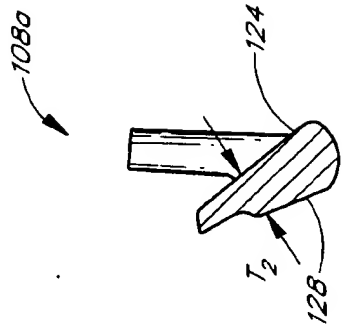


FIG. 14

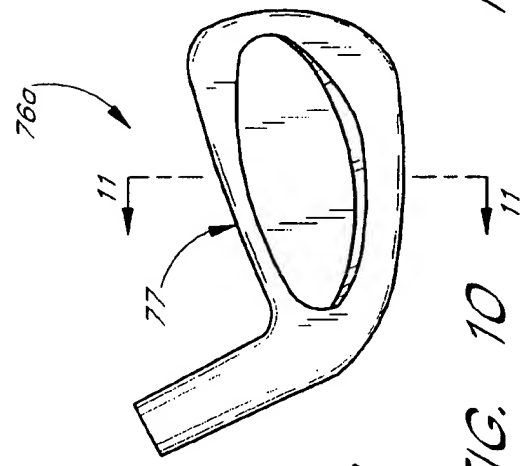


FIG. 10

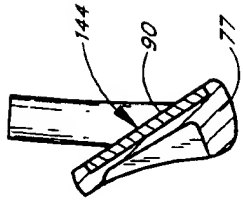


FIG. 11

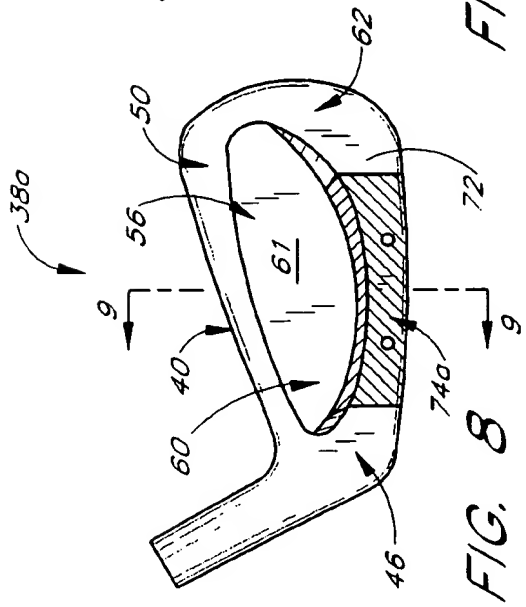


FIG. 8

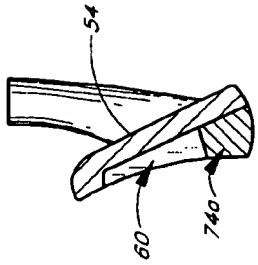


FIG. 9

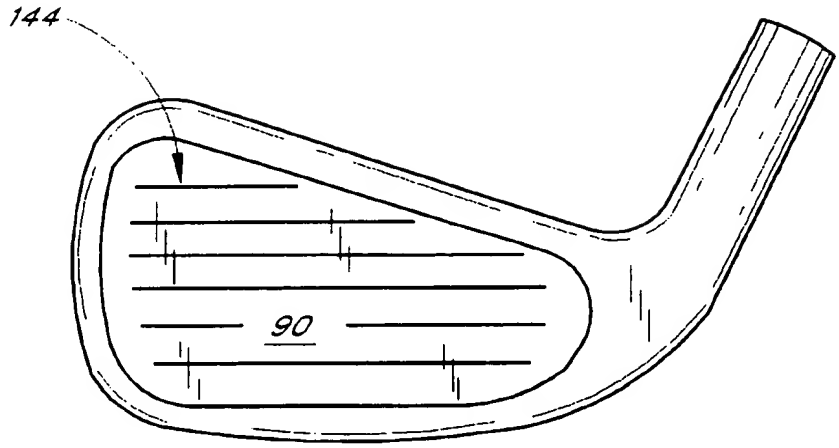


FIG. 12

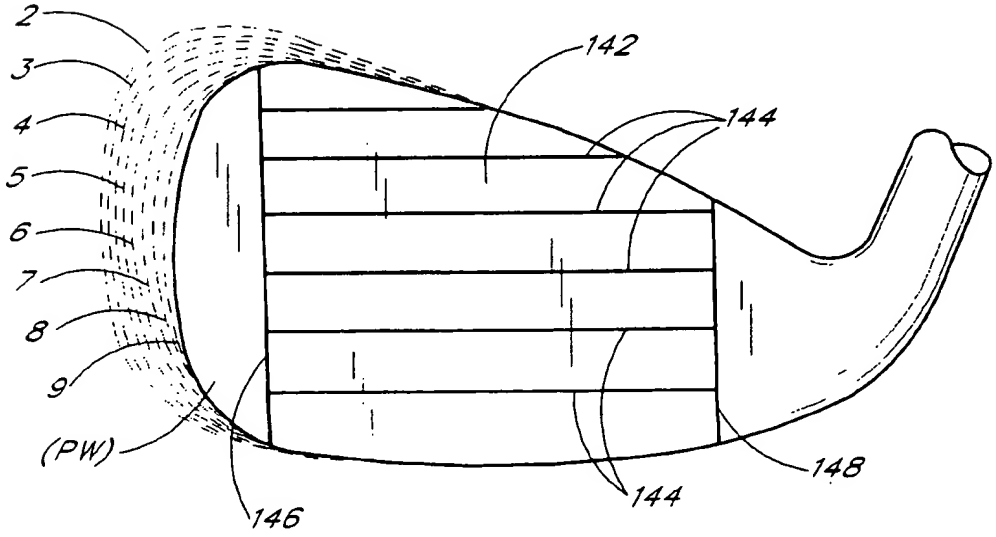


FIG. 28

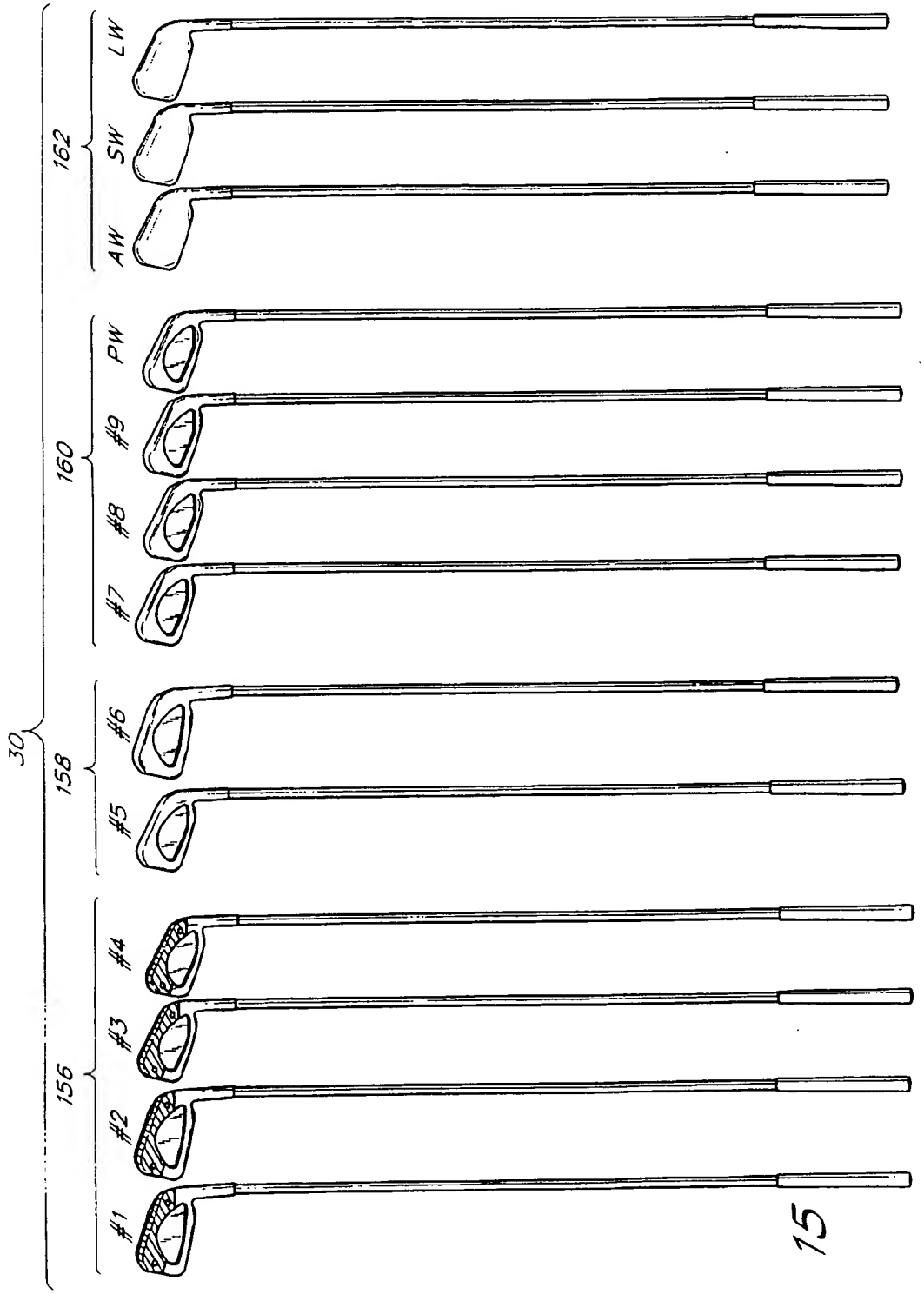


FIG. 15

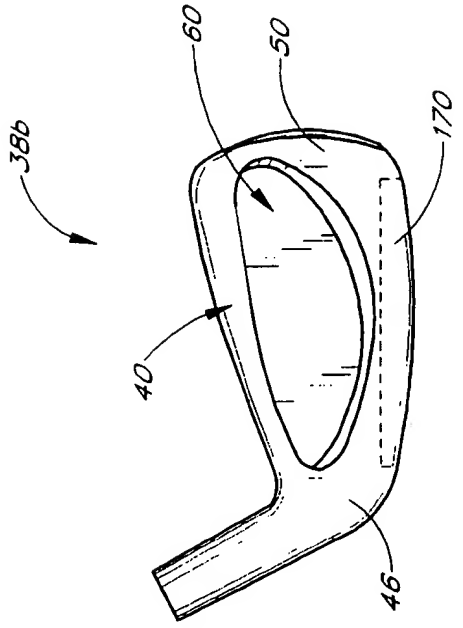


FIG. 18

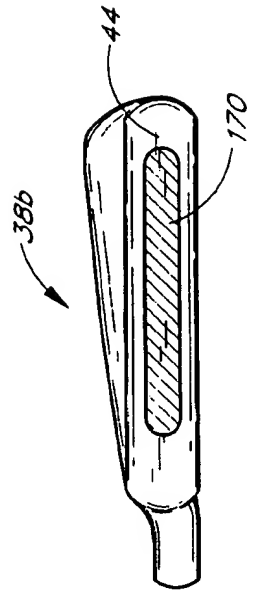


FIG. 19

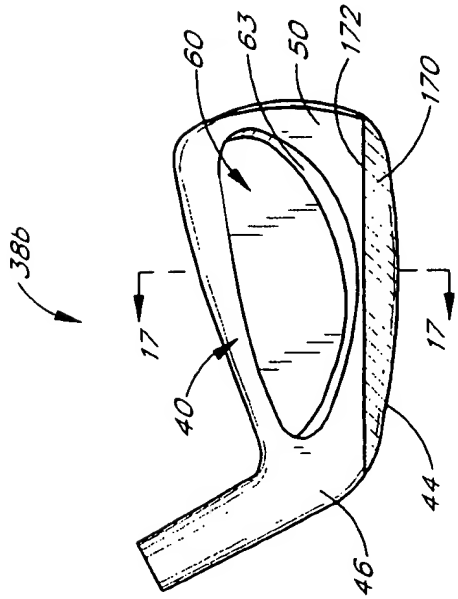


FIG. 16

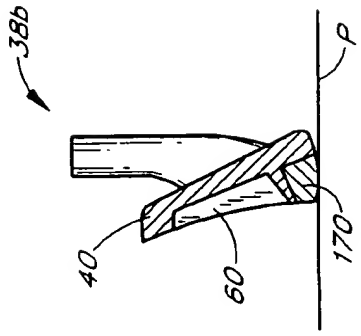


FIG. 17

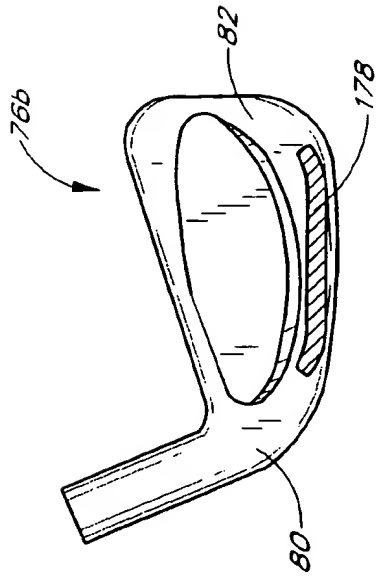


FIG. 22

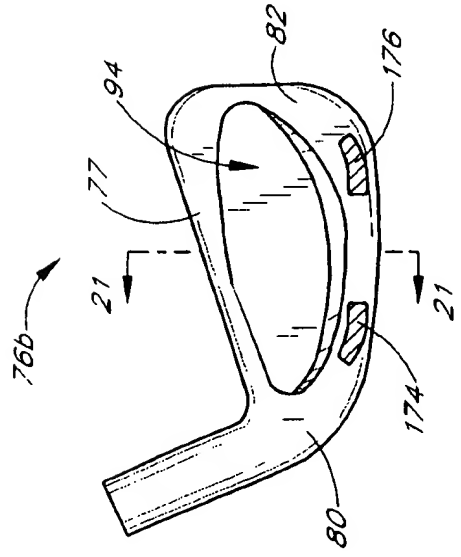


FIG. 20

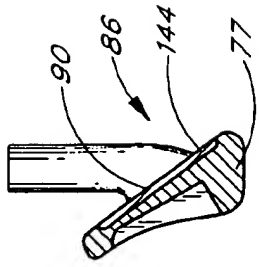


FIG. 21

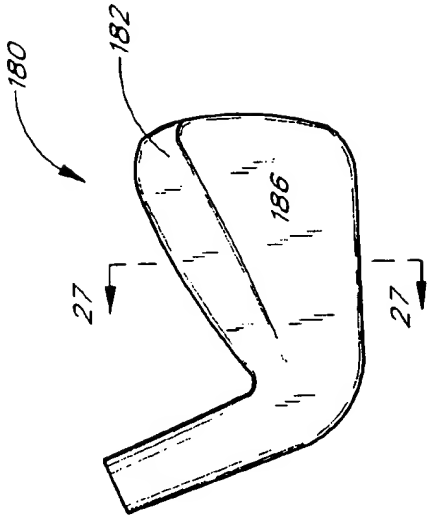


FIG. 26

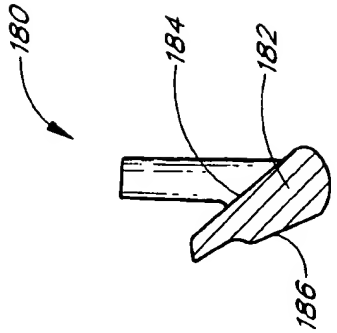


FIG. 27

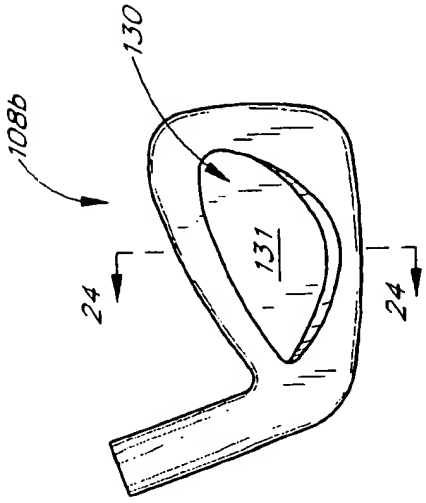


FIG. 23

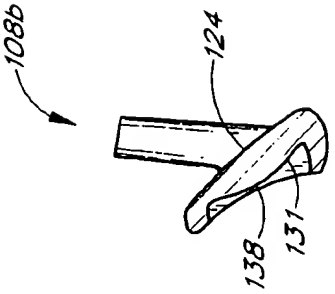


FIG. 25

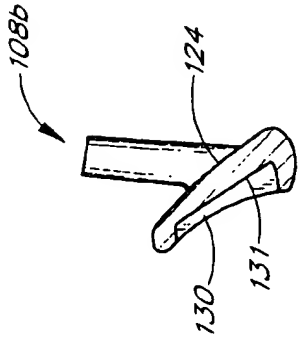


FIG. 24

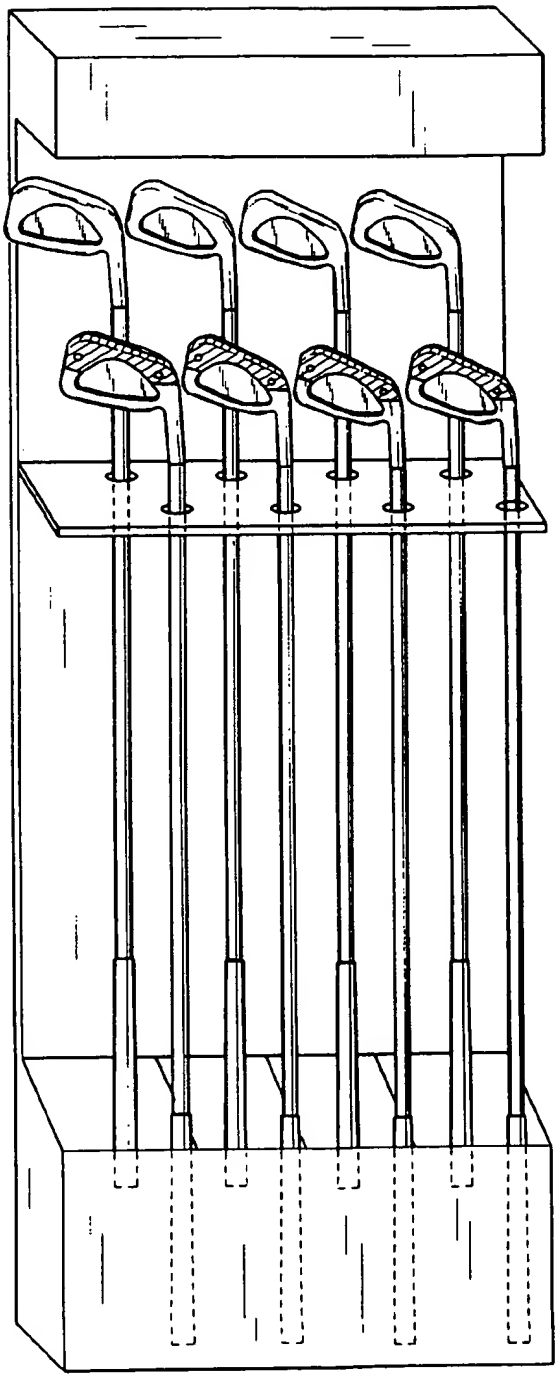


FIG. 29

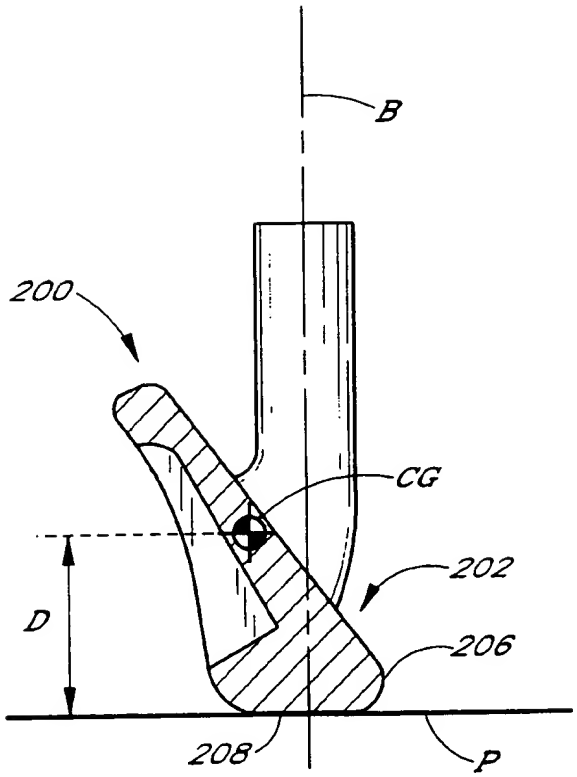

B
200
CG
202
D
206
208
P

FIG. 30

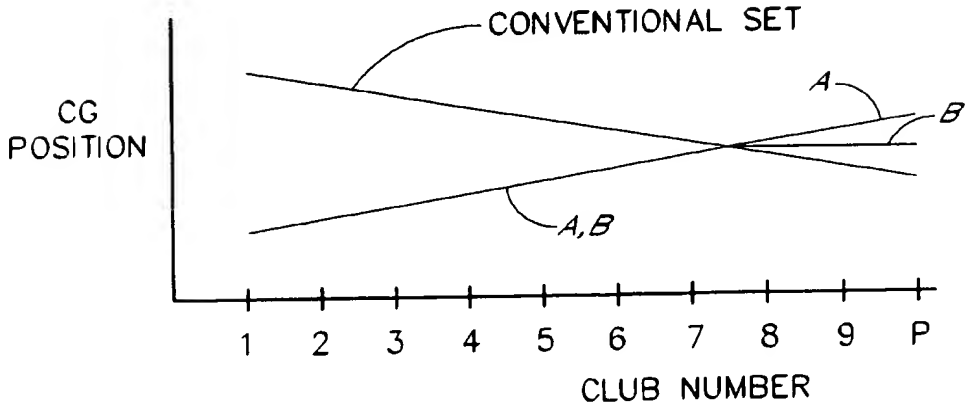

CONVENTIONAL SET
A
B
CG
POSITION
A,B
1 2 3 4 5 6 7 8 9 P
CLUB NUMBER

FIG. 31

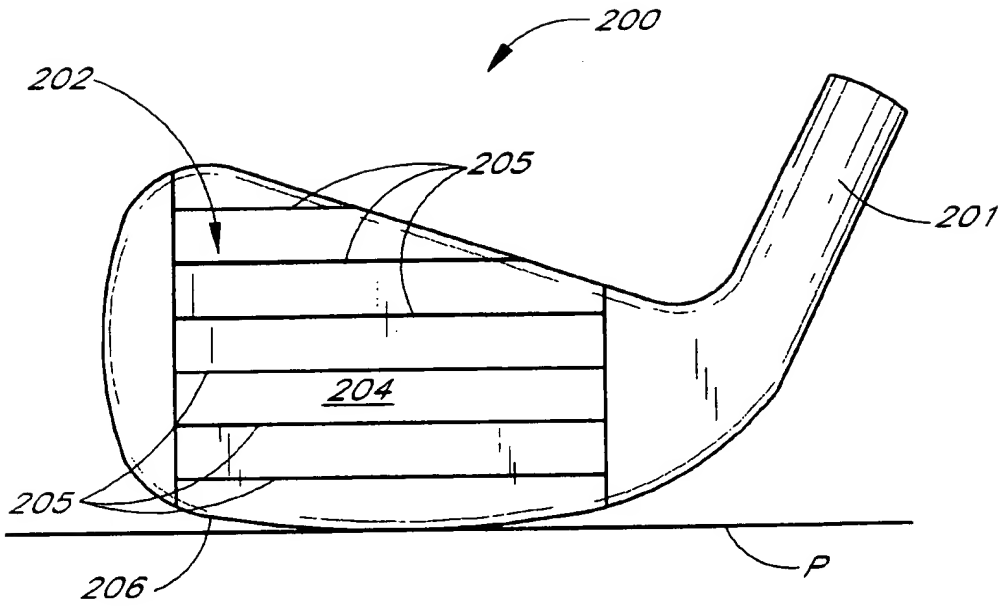


FIG. 30A

CORRELATED SET OF GOLF CLUBS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to golf. More particularly, the present invention relates to a set of iron-type golf clubs.

2. Description of the Related Art and Summary of the Invention

A typical set of golf clubs includes a set of wood-type clubs for hitting the ball off the tee and for long shots, a set of iron-type clubs for long, medium, and short shots, and a putter to roll the ball on the green. Of all the clubs in a set, the iron-type clubs, or "irons," typically encounter the most variations in shot distances and the most variations in ground, obstacle and lie conditions.

The irons are numbered with designations from 1 through 9 and with individual wedge designations. For example, the iron which could essentially be designated number 10 is designated PW (pitching wedge). Additional wedges are often provided to provide even greater loft to the ball than a pitching wedge. Within a set, the higher the number designation, the greater the loft of the club. The lower numbered or long irons hit the ball the longest distance and are the most difficult to play, as it is relatively hard for the average golfer to get the ball airborne with the long irons. Golf club manufacturers thus try to design long irons that are easier to hit and more forgiving of off-centered shots. The medium numbered irons hit the ball a medium distance. The medium irons are typically designed to be both easy to hit and accurate. The shortest irons hit the ball the shortest distance and are used to land the ball closer to the target. As the location where the ball lands on the green is critical, more controllability and precision over the ball is required for the short irons. For the average golfer it is much easier to get the ball airborne with the short irons than with the long irons.

Unlike woods and putters, golfers typically purchase the irons as a correlated set which includes a large range of clubs. The clubs in such a set are designed to work together to reliably provide a golfer with predictable and progressive increments in shot distance from the lower numbered clubs to the higher numbered clubs. For example, a certain golfer may hit the ball 150 yards using the 7 iron, 160 yard using the 6 iron, 170 yards using the 5 iron, and so on. Thus, a golfer playing with a correlated set of irons may choose with confidence the iron that is most suited for the particular shot type and shot distance being encountered. This is not necessarily true with a random collection of irons where the incremental difference in shot distance between the clubs may not be coordinated.

Additionally, each of the clubs in a correlated set typically share a consistent look, such as consistent markings, color combinations, or the type of polishing or texture of the club head and shaft. Although the common features do not necessarily affect the playability of the clubs, golfers generally feel most comfortable when playing with a correlated set of irons, rather than with a group of irons that was randomly collected. A correlated set of irons thus contributes to the important mental aspects of a golfer's game by increasing the golfer's confidence when hitting the ball.

Golf club manufacturers progressively vary certain standard structural features of the irons in a correlated set to achieve the difference in ball distance from the lower numbered to the higher numbered clubs. For example, the loft angle of the clubs, which is the angle between a vertical plane passing through the shaft axis and a plane passing through the strike surface of the club head, progressively increases moving from the long irons to the short irons. The greater loft angle in the short irons gives these irons an increased tendency to lift the ball upon impact so that the ball travels a shorter distance. Another standard structural feature that is varied is the length of the club shaft, which decreases moving from the long clubs to the short clubs. The lie angles of the irons are also varied to accommodate the different lengths of shafts throughout the complete set of iron clubs.

U.S. Pat. Nos. 5,480,145, 5,665,009, and 5,388,826 to Sherwood disclose a correlated set of golf clubs having features that vary progressively from the lower numbered clubs to the higher numbered clubs. For example, the long irons have a larger planar strike area than the shorter irons to increase the size of the sweet spot for the long irons. These patents also disclose that the size of the rear cavity on the irons may decrease as the club shaft becomes shorter.

While manufacturers have varied the aforementioned features throughout the clubs in a single set of irons, there are also certain fundamental or basic design characteristics that have conventionally remained constant or homogeneous throughout all of the clubs in a coordinated, conventional set of irons. For example, one correlated set of irons may have a "cavity back" design wherein all of the clubs in the set have a cavity on the rear face of the club head. The cavity promotes a peripheral distribution of mass to increase the size of the sweet spot of the club and thereby makes the club easier to hit. Another correlated set of irons may have a "blade" design wherein all of the club heads generally are in the shape of a flattened blade. The blade design concentrates more mass directly behind the ball for a more solid and more controllable shot than the cavity-back irons. Specifically, a blade design provides the golfer with greater feedback to enable the golfer to more precisely alter a stroke to achieve the desired results. Thus, the cavity-back type of irons generally provide a more forgiving, although less controllable, shot than blade-type irons.

Yet another basic design characteristic that typically remains constant throughout all of the clubs in a coordinated, conventional set of irons is the material that is used to manufacture the club heads. For example, one correlated set of irons may comprise heads manufactured of titanium, which is a strong, lightweight material. Unfortunately, a set of titanium clubs is extremely expensive because of the high cost of titanium. Another correlated set of iron clubs may have heads that are manufactured of steel. A set of steel clubs is less expensive than titanium clubs.

Unfortunately, the performance of the specific clubs in a set may be adversely affected if all of the clubs include the same basic design characteristics. For example, the increased precision of the blade design may not be optimal for the long irons, where the emphasis should be toward enhancing the playability of the clubs by making it easier to get the ball airborne. Likewise, the cavity-back design is not necessarily suited for the shortest irons, which should emphasize feel and feedback and, therefore, controllability of the ball.

Additionally, the material used to manufacture the club head should not necessarily be consistent throughout all of the clubs in a correlated set. The use of light-weight titanium is highly suited for the longer irons, where the weight savings allows the club head to be made larger to increase the size of the sweet spot. However, using titanium may be inefficient and unnecessarily costly for the shorter irons, where controllability of the ball, rather than weight savings, is emphasized.

The design characteristics of the clubs should be specifically directed toward improving the specific playing needs of each of the clubs or groups of clubs in the set. For example, the properties of easy playability and forgiveness should be promoted for the long irons. The property of controllability of the shot should be promoted for the short irons. The middle irons should preferably be designed to compromise between playability and precision. These objectives are not necessarily accomplished if the clubs in a correlated set are united by a single, basic design characteristic.

There is therefore a need for a correlated set of golf clubs wherein each club or a group of clubs in the set utilizes technology that is specifically designed to promote the playing needs of that particular type of club.

In one aspect of the invention, there is disclosed a correlated set of golf clubs, comprising at least a first iron having a first club head. The first club head has a first loft designation and a first center of gravity located a first vertical distance from the ground plane when the club head is in address position. The set also comprises a second iron having a second club head. The second club head has a second loft designation designating a higher loft than the first loft designation and a second center of gravity located a second vertical distance from the ground plane when the club head is in address position. The second vertical distance is longer than the first vertical distance. The set further comprises a third iron having a third club head, the third club head having a third loft designation designating a higher loft than the second loft designation and a third center of gravity located a third vertical distance from the ground plane when the club head is in address position. The third vertical distance is longer than the second vertical distance.

Another aspect of the invention relates to a correlated set of golf clubs. The set comprises a first iron having a first club head, the first club head having a loft designation "3" and a first center of gravity located a first vertical distance from the ground plane when the club head is in address position; a second iron having a second club head, the second club head having a loft designation of one of "2" and "4" and a second center of gravity located a second vertical distance from the ground plane when the club head is in address position; a third iron having a third club head, the third club head having a loft designation of "5" and a third center of gravity located a third vertical distance from the ground plane when the club head is in address position; and a fourth iron having a fourth club head, the fourth club head having a loft designation of one of "4" and "6" and a fourth center of gravity located a fourth vertical distance from the ground plane when the club head is in address position. Each of the club heads have a unique loft designation and the first vertical distance is shorter than either of the third vertical distance and the fourth vertical distance. Additionally, the second vertical distance is shorter than either of the third vertical distance and the fourth vertical distance.

In yet another aspect of the invention, there is disclosed a correlated set of golf clubs, comprising a first iron having a first club head, the first club head having a loft designation "3" and a first center of gravity located a first vertical distance from the ground plane when the club head is in address position; a second iron having a second club head, the second club head having a loft designation "4" and a second center of gravity located a second vertical distance from the ground plane when the club head is in address position; a third iron having a third club head, the third club head having a loft designation of "5" and a third center of gravity located a third vertical distance from the ground plane when the club head is in address position; a fourth iron having a fourth club head, the fourth club head having a loft designation "6" and a fourth center of gravity located a fourth vertical distance from the ground plane when the club head is in address position; a fifth iron having a fifth club head, the fifth club head having a loft designation "7" and a fifth center of gravity located a fifth vertical distance from the ground plane when the club head is in address position, wherein none of the loft designations are identical and the first vertical distance is shorter than the fifth vertical distance, and the second vertical distance is shorter than the fifth vertical distance; and a sixth iron having a sixth club head, the sixth club head having a loft designation "8" and a sixth center of gravity located a sixth vertical distance from the ground plane when the club head is in address position. Each of the first vertical distance, the second vertical distance, the third vertical distance and the fourth vertical distance are at least as short as each of the fifth vertical distance and the sixth vertical distance.

In yet another aspect of the invention, there is disclosed a set of golf clubs comprising at least a first group of golf clubs, wherein each of the clubs in the first group comprises a club head having a main body of a first material having a first density; and at least a second group of golf clubs, wherein each of the clubs in the second group comprises a club head having a main body of a second material having a second density higher than the first density, wherein the first group of clubs comprise lower numbered clubs than the second group of clubs. Desirably, each of the clubs heads of the first group of clubs comprises a face, a sole, and a rear cavity surrounded by a peripheral belt of mass, and a separate weight insert of material having a higher density than the first density. The weight insert is positioned on a lower portion of the peripheral belt of mass so as to shift the center of gravity of the each of the club heads of the first group toward the sole. Each of the heads of the second group of clubs comprises a face, a sole, and a rear cavity surrounded by a unitary peripheral belt of mass.

In one embodiment, each of the club heads in the second group is made entirely of a single piece of the same type of one of metal and metal alloy. Each of the club heads of the second group includes at least one weight insert positioned on a lower portion of the peripheral belt of mass of the club heads of the second group. The weight inserts of the club heads of the first and second groups group are positioned below annular surfaces surrounding the rear cavities of the club heads.

In one embodiment, each of the club heads of the second group further comprises a separate face insert. The face insert of each of the club heads of the second group is manufactured of titanium. In another embodiment, the face insert of each of the club heads of the second group is manufactured of one of a titanium alloy, aluminum and an aluminum alloy. The at least one weight insert of each of the club heads of the second group is desirably made of a tungsten alloy. The first material mentioned above desirably comprises one of titanium and a titanium alloy, and the weight inserts of the first set of clubs are made of a tungsten-based material. The second material comprises one of steel and a steel alloy.

Another embodiment additionally comprises a third group of clubs, wherein each of the clubs in the third group comprises a club head having a face and a sole wherein the clubs of the third group have lower numbers than the clubs of the second group and wherein the clubs heads of the third group are made of higher density material than the club heads of the first group. The club heads of the third group are

preferably made of steel and may have a rear cavity surrounded by a peripheral belt of mass.

The first group of clubs may comprises clubs from the set of 1, 2, 3, 4, 5, and 6 numbered clubs; the second group of clubs may comprises clubs from the set of 7, 8, and 9 numbered clubs and the pitching wedge; and the third group of clubs may comprise clubs from the set of the approach wedge, the sand wedge, and the lob wedge.

Yet another embodiment additionally comprises a fourth group of clubs having higher numbers than the clubs of the third group, wherein each of the clubs in the fourth group comprises a club head having a face and a sole and wherein the club heads of the fourth group are made of higher density material than the club heads of the first group. The club heads of the fourth group are desirably made of steel.

In one embodiment, the first group of clubs comprises clubs from the set of 1, 2, 3, 4 and 5 numbered clubs; the second group comprises clubs from the set of 6 and 7 numbered clubs; the third group comprises clubs from the set of 8 and 9 numbered clubs and a pitching wedge; and the fourth group comprises clubs from the set of the approach wedge, the sand wedge, and the lob wedge. A single piece of packaging preferably enclosing the set of golf clubs.

Yet another aspect of the invention relates to a set of golf clubs. The set comprises a first group of golf clubs, each of the first group of golf clubs having a head and a loft designation, and a second group of golf clubs, each of the second group of golf clubs having a head and a loft designation. The loft designation of each of the first group of golf clubs and each of the second group of golf clubs is unique. Additionally, each loft designation of the second group of golf clubs is higher than each loft designation of the first group of golf clubs. Each of the first group of golf clubs and the second group of golf clubs has a substantially same strike surface indicia and substantially the same loft designation typestyle. Desirably, the head of each of the first group of golf clubs differs from the head of each of the second group of golf clubs in at least one from the group of density and the existence of separate weight inserts.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will now be described with reference to the drawings of a preferred embodiment, which are intended to illustrate and not to limit the invention, and in which:

FIG. 1 is a side view of a set of iron-type golf clubs of the present invention;

FIG. 1A is an enlarged side view of the heads of the golf clubs of FIG. 1;

FIG. 2 is a rear view of a long iron-type golf club head of the present invention;

FIG. 3 is a cross-sectional view of the golf club head of FIG. 2 along line 3—3;

FIG. 4 is a rear view of a middle iron-type golf club head of the present invention;

FIG. 5 is a cross-sectional view of the golf club head of FIG. 4 along line 5—5;

FIG. 6 is a rear view of a short iron-type golf club head of the present invention;

FIG. 7 is a cross-sectional view of the golf club head of FIG. 6 along line 7—7;

FIG. 8 is a rear view of a second embodiment of a long iron-type golf club head of the present invention;

FIG. 9 is a cross-sectional view of the golf club head of FIG. 8 along line 9—9;

FIG. 10 is a rear view of a second embodiment of a middle iron-type golf club head of the present invention;

FIG. 11 is a cross-sectional view of the golf club head of FIG. 10 along line 10—10;

FIG. 12 is a front view of the golf club head of FIG. 10;

FIG. 13 is a rear view of a second embodiment of a short iron-type golf club head of the present invention;

FIG. 14 is a cross-sectional view of the golf club head of FIG. 13 along line 13—13;

FIG. 15 is a side view of another embodiment of the set of iron-type golf clubs of the present invention;

FIG. 16 is a rear view of a long iron-type club of the set of FIG. 15;

FIG. 17 is a cross-sectional view of the club of FIG. 16 along line 17—17;

FIG. 18 is a rear view of a second embodiment of the club of FIG. 16;

FIG. 19 is a bottom view of the club of FIG. 18;

FIG. 20 is a rear view of a middle iron-type golf club of the set of FIG. 15;

FIG. 21 is a cross-sectional view of the club of FIG. 20 along line 21—21;

FIG. 22 is a rear view of another embodiment of the club of FIG. 20;

FIG. 23 is a rear view of a short iron-type golf club of the set of FIG. 15;

FIG. 24 is a cross-sectional view of the club of FIG. 23;

FIG. 25 is another embodiment of the club of FIG. 23;

FIG. 26 is a rear view of a wedge-type iron club of the set of FIG. 15;

FIG. 27 is a cross-sectional view of the club of FIG. 26;

FIG. 28 illustrates the possible variation in size of the strike surfaces of the golf club heads of the present invention;

FIG. 29 is a perspective view of a packaged set of golf clubs of the present invention;

FIG. 30 is a side view of an iron club in an address position;

FIG. 30A is a front view of the iron club of FIG. 30; and

FIG. 31 is a graph showing the vertical position of the center of gravity of the clubs heads of the golf club set of the present invention as a function of club number.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a set 30 of iron-type golf clubs. The set 30 generally comprises a first group 32 of iron-type golf clubs, a second group 34 of iron-type golf clubs, and a third group 36 of iron-type golf clubs. Each golf club within a common group has structural properties that are selected to enhance the specific playing requirements of the type of club within the group, as described in more detail below. The structural properties of the clubs provide a unique trend in the vertical positions of the centers of gravity of the club heads in the set 30 wherein the vertical distance of the center of gravity to ground is smaller for the long irons than the medium or short irons, as described in more detail below.

In the embodiment shown in FIG. 1, the first group 32 preferably includes the long irons, such as, for example, the 1, 2, 3, 4 and 5 irons. The second group 34 preferably includes the middle or medium irons, such as, for example, the 6, 7, 8 and 9 irons. The third group 36 preferably

includes the short irons, such as, for example, the sand wedge and the pitching wedge. Preferably, each club is only within one of the groups **32**, **34**, or **36** for a given set **30** of clubs. Desirably, as shown in FIG. **29**, the entire set **30** of clubs is packaged within a single piece of packaging, such as a carton designed for shipment and, preferably, display of the set of irons.

In another embodiment, the first group **32** includes the 1–4, 1–5, or 1–6 irons, the second group **34** includes the next clubs in sequence after the last club in the first group **32** up to the 9 iron or pitching wedge, and the third group **36** includes the next clubs in sequence after the last club in the second group **34** up to the lob wedge.

The numerical indicia of each club in the set **30** may also be described with reference to associated loft angles of the clubs. In one embodiment, the clubs have the loft angles set forth below with a variance in the range of ±4°.

1 iron	16°
2 iron	19°
3 iron	21°
4 iron	24°
5 iron	27°
6 iron	30°
7 iron	33°
8 iron	37°
9 iron	41°
pitching wedge	45°
approach wedge	50°
sand wedge	55°
lob wedge	60°

As shown in FIG. 1A, each of the clubs in the set **30** includes a unique marking **31** which denotes the loft designation or club number of each of the clubs. The marking **31** typically comprises a numeral, but could also comprise any other symbols, such as a letter. Although the particular marking **31** is unique for each of the clubs, the typestyle or font of the marking **31** is desirably identical for each of the clubs. Each of the clubs in the set **30** also includes a designation or logo **33** which, for example, may designate the source of the clubs. In the illustrated embodiment, the logo **33** is shown as "XYZ" although any of a wide variety of symbols may be used. Desirably, the logo **33** and the associated typeset or font is identical for all of the clubs in the set **30**. The set **30** could include other consistent markings or indicia that indicate that the clubs belong to the set **30**.

FIG. **2** is a rear view of an iron-type golf club head **38** from the first group **32**. FIG. **3** is a cross-sectional side view of the club head **38** along line 3—3 of FIG. **2**. All four iron heads in the first group **32** have the same general structure, which generally comprises a main body **40** and a weight insert **74** attached thereto, as described in more detail below. A hosel **41** extends upwardly from the main body **40** for attaching to a shaft in a well known manner. The main body **40** includes an upper portion **42**, a lower portion or sole **44**, a heel portion **46** and a toe portion **50**. The main body **40** further includes a front side **52** (FIG. **3**) that defines a strike surface **54** for striking a golf ball, and a rear side **56** which includes a rear cavity **60** that extends into the golf club head **38** toward the front side **52**. The rear cavity **60** forms a substantially flat back or base surface **61** that is opposed to the strike surface **54**. An annular surface **63** extends outwardly from the base surface **61** and defines the periphery of the rear cavity **60**.

The strike surface **54** is oriented at a loft angle A relative to a line l—l passing through the axis B of the hosel **41**. The loft angle A gradually increases as the club number increases for the clubs in the first group **32**. Thus, although the club heads in the first group **32** have the same general structure, at least the loft angle desirably differs for each of the clubs in the first group **32**.

The rear cavity **60** of the golf club head **38** is surrounded by a peripheral mass belt **62** comprising an extent of mass that surrounds the rear cavity **60**. The peripheral mass belt **62** promotes a peripheral distribution of mass to maximize the inertia and increase the "sweet spot" of the golf club head **38**.

The peripheral mass belt **62** includes a heel perimeter region **64** extending generally upwardly along the heel portion **46** of the club head **38**, and a toe perimeter region **66** extending generally upwardly along the toe portion **50** of the club head **38**. The peripheral mass belt **62** further includes an upper perimeter region **70** extending longitudinally along the upper portion **42** between upper edges of the heel perimeter region **64** and the toe perimeter region **66**, and a lower perimeter region **72** extending longitudinally along the sole portion **44** of the club head **38** between lower edges of the heel perimeter region **64** and the toe perimeter region **66**. The peripheral mass belt **62** forms a substantially flat rear surface **73**. The peripheral mass belt **62** could also extend only partially around the rear cavity **60** and could vary in thickness at various locations.

A weight insert **74** is attached to the main body **40** and forms the lower perimeter region **72** of the peripheral mass belt **62**. As best shown in FIG. **2**, the weight insert **74** extends horizontally along the lower perimeter region **72** and slightly upward along the toe perimeter region **66** and the heel perimeter region **64** so that the weight insert has a crescent-like shape. As shown in FIG. **3**, the weight insert **74** has a thickness that extends from the rear surface **73** of the peripheral mass belt **62** to the base surface **61** of the rear cavity **60** so that the peripheral mass belt **62** forms the lower region of the annular surface **63**. The weight insert **74** is preferably located in a very low position on the club head **38** and toward the rear side **56** of the club head **38**. Any suitable means, may be used to attach the weight insert **74** to the golf club head **38** such as, for example, screws, adhesion bonding, welding, brazing, press fitting, or any combination thereof.

The main body **40** preferably constitutes the main portion of the volume of the club head **38**. Preferably, the weight insert **74** represents 20% to 70% of the total weight of the club head **38** but comprises less than 50% of the total volume of the club head **38**. More preferably, the weight insert **74** represents 35% to 60% of the total weight of the club head **38**. Even more preferably, the weight insert **74** represents 45% to 60% of the total weight of the club head **38**. As an example, for a 3-iron head having a total weight of 245 grams, the weight insert **74** is preferably approximately 100 grams, or 41% of the total weight of the 3-iron head. The main body **40** of the golf club head **38** is preferably made of a material having a low density (i.e., less than 7 grams per cubic centimeter). However, the main body **40** should also have high mechanical characteristics, such as a high elastic strength. In one embodiment, the main body **40** of the golf club head **38** is manufactured of titanium or a titanium alloy having a density of approximately 4.5 grams per cubic centimeter. Suitable materials are a Ti-6Al-4V-type alloy, which has an elastic strength on the order of 120,000 psi, or a Ti-3Al-2.5V-type alloy, which has an elastic strength on the order of 90,000 psi.

The weight insert **74** is preferably manufactured of a high density material (i.e., greater than at least 10 grams per cubic

centimeter, and preferably between 12 and 20 grams per cubic centimeter). Some suitable materials for the weight insert **74** are tungsten, which has a density of approximately 19 grams per cubic centimeter, or a sintered mixture of tungsten and other metallic powders, such as iron, nickel, and/or copper. Preferably, the weight insert **74** does not increase the total weight of the club head **38** above a desired value, preferably 245 grams for a 3-iron, but rather redistributes the mass in a predetermined manner to enhance the hitting characteristics of the clubs in the first group **32**. That is, the position, shape, and material of the weight insert **74** is particularly directed toward the playing needs or requirements of the long irons, with which golfers generally have a difficult time getting the ball airborne.

As mentioned, the weight insert **74** is generally located in the sole portion **44** of the club head **38** so that the weight insert **74** has a low position on the club head **38**. The low position of the weight insert **74** significantly lowers the center of gravity CG_1 of the club head **38** so that more mass is below the golf ball at impact, which facilitates launching of the ball. Additionally, a weight insert which extends from the toe portion **50** to the heel portion **46**, such as the crescent-like shaped weight insert **74** illustrated in FIG. **2**, creates a high moment of inertia about a vertical axis through the center of gravity to thereby provide more forgiveness for off-center hits. The position of the weight insert **74** on the rear side **56** also improves the playability of the club head **38**. The structure of the club head **38** of the first group **32** thus particularly improves the playability of the long irons by making it easier for the golfer to get the ball airborne and providing more forgiveness for off-center shots.

FIG. **4** is a rear view of a golf club head **76** from the second group **34**. FIG. **5** is a cross-sectional view of the golf club head **76** along line **5**—**5** of FIG. **4**. All of the club heads in the second group **34** have the same general structure of the club head **76**, which is particularly directed toward enhancing the playing needs of the medium irons. However, at least the loft angle A differs between the club heads in the second group.

The golf club head **76** generally comprises a unitary main body **77** which is formed of a single piece of material and does not have a weight insert. The main body **77** includes an upper portion **78**, a heel portion **80**, a toe portion **82**, and a lower portion or sole **84**. The main body **77** also includes a front side **86** having a front strike surface **90** oriented at a loft angle A and a rear side **92** having a rear cavity **94** that extends toward the strike surface **90**. The rear cavity **60** forms a substantially flat rear or base surface **95** that is opposed to the strike surface **54**. An annular surface **97** extends outwardly from the base surface **94** and defines the periphery of the rear cavity **92**.

A peripheral mass belt **96** extends around the perimeter of the cavity **94** and preferably forms a continuous extended mass that surrounds the cavity **94**. The peripheral mass belt **96** includes a heel perimeter region **98** extending generally upward along the heel portion **80** and a toe perimeter region **100** extending generally upwardly along the toe portion **82**. The peripheral mass belt **96** further includes an upper perimeter region **104** extending longitudinally along the upper portion **78** between upper edges of the heel perimeter region **98** and the toe perimeter region **100**, and a lower perimeter region **106** extending longitudinally along the sole portion **84** between lower edges of the heel perimeter region **98** and the toe perimeter region **100**. As mentioned, the peripheral mass belt **96** comprises a single extent of mass of the golf club head **76** illustrated in FIGS. **4** and **5** and thus does not include a weight insert like the golf club head **38** of the first group **32**.

The club head **76** of the second group **34** desirably has a similar general shape as the club head **38** of the first group **32**. However, the club head **76** of the second group **34** is preferably smaller in size than the club head **38** in the first group **32** in order to provide more precision or control in the shot while still having a relatively large sweet spot. The club head **76** is thus suited for the medium irons, which should emphasize both precision and playability. The set **30** could also be divided into two groups, wherein the first group includes the 1–4, 1–5, or 1–6 irons and the second group includes the next clubs in sequence after the last club in the first group up to the lob wedge.

The club head **76** of the second group **34** is preferably manufactured of a material having a higher density than the main body **40** of the club head **38** of the first group **32**. Desirably, the club head **76** is manufactured of a material having a density greater than 5 grams per cubic centimeter, and more preferably between 6 and 9 grams per cubic centimeter. The aforementioned range of densities allows for the production of heads with the aforementioned structure and also allows the manufacturer to position the center of gravity to suit playing needs of the clubs in the second group **34**.

The choice of a higher density material also allows the club head **76** in the second group **34** to be made smaller in size while maintaining the conventional total weight of the head. A 7-iron has a conventional total head weight of approximately 270 grams. Preferably, the club head **76** in the second group **34** is manufactured of a steel or a steel alloy. Advantageously, steel is less expensive than titanium so that the cost of the set **30** of clubs is reduced by using steel where appropriate.

FIG. **6** is a rear view of a club head **108** from the third group **36**. FIG. **7** is a cross-sectional view of the club head **108** along line **7**—**7** of FIG. **6**. As mentioned, the third group **36** of clubs heads preferably includes the short irons, such as the pitching wedge and the sand wedge. All club heads in the third group **36** have the same general structure of the club head **108**, which is particularly directed toward enhancing the playing needs of the short irons, such as improving the control of these irons. Desirably, the position of the centers of gravity CG_1, CG_2, CG_3, gradually moves upward relative to the sole portions of the clubs moving from the first group **32** to the second group **34**, to the third group **36**, as described in greater detail below.

The club head **108** generally comprises a unitary main body **110** having a hosel **111** extending upwardly therefrom. The main body **110** includes an upper portion **112**, a sole portion **114**, a heel portion **116**, and a toe portion **120**. The club head **108** also includes a front side **122** having a strike surface **124**, and a rear side **126** including a rear cavity **130**. The rear cavity **130** forms a rear or base surface **131** that is opposed to the strike surface **124**. An annular surface **134** extends outwardly from the base surface **131** and defines the periphery of the rear cavity **92**. A peripheral mass belt **132** surrounds the rear cavity **130**.

The rear cavity **130** preferably has a volume that is smaller than the volume of the rear cavity **94** in the club head **76** of the second group **34**. The distribution of mass to the periphery of the club head **108** is thus limited to thereby concentrate more mass behind the ball and improve the feel and control of the club head **108**. Desirably, the volume of the rear cavity **130** may be reduced by varying the thickness t of the club head **108** in the region of the rear cavity **130**.

The thickness t is the distance from the strike surface **124** to the base surface **131** of the rear cavity **130**.

FIG. **7** illustrates the preferred distribution of mass in the rear cavity **130**. The base surface **131** includes a bulged or thick portion **138** at the center of the base surface **131**. The thick portion **138** is formed by the base surface **131** curving outwardly so as to define an increased thickness t at the center of the base surface **131**. The thickness t of the club head **108** preferably gradually decreases moving away from the thick portion **138** toward the annular surface **135** in order to form a progressive thickness variation. Desirably, the thickness t of the club head **108** in the region of the rear cavity **130** also increases toward the sole portion **114** to concentrate more mass near the sole portion **114** so that the center of gravity CG_3 of the club head **108** is relatively close to the sole portion **114**. Desirably, the center of gravity CG_3 is approximately 0.7 inches from the bottom surface of the club head **108**. Preferably, the bulged portion **138** is located behind the point on the strike surface **124** where the ball impacts the club head **108**.

The club head **108** of the third group **36** is preferably made of a higher density material than the main body **40** of the club head **38** in the first group **30**. The material may be the same or different as the material used to manufacture the club head **76** of the second group **34**. However, if the material is different than that of the second group **34**, the material is preferably of a higher density in the range of 7–9 grams per cubic centimeter. In a preferred embodiment, the club head **108** of the third group is manufactured of steel or a steel alloy. Appropriate materials also include nickel alloys and copper alloys.

FIGS. **8–14** illustrate alternative embodiments of the clubs heads from the first group **32**, the second group **34**, and the third group **36**. For convenience, like numerals will be used to designate like parts between the two embodiments.

FIG. **8** is a rear view of an alternative embodiment of a long iron club head **38***a* from the first group **32**. The club head **38***a* has essentially the same structure as the club head **38** of the previous embodiment. However, in this embodiment, the weight insert **74***a* occupies a more central portion of the lower perimeter region **72** of the peripheral mass belt **62** so that the weight insert **74***a* is smaller from heel to toe in size than the weight insert **74** (FIG. **2**) from the first embodiment. The weight insert **74***a* does not extend entirely from the toe portion **50** to the heel portion **46**. The weight insert **74***a* lowers the center of gravity CG_1 of the club head **38***a*, as described above with respect to the previous embodiment. However, the moment of inertia around a vertical axis passing through the center of gravity is kept at a lower value than the club head **38** of the first embodiment to provide enhanced feedback to the golfer regarding off-center hits and force of impact.

FIG. **10** is a rear view of a second embodiment of a club head **76***a* from the second group **34**. FIG. **11** is a cross-sectional view of the club head **76***a* along line **11—11**, and FIG. **12** is a front view of the golf club head **76***a*. The club head **76***a* has essentially the same structure as the club head **76** of the first embodiment. However, the club head **76***a* includes a separate face insert **144** that is attached to the front side **86** of the main body **77** of the club head **76***a*. The face insert **144** forms the strike surface **90**. The face insert **144** is preferably formed of a material having a lower density than the density of the main body **77** of the head **76***a*. A thinner insert formed from an equivalent density, but higher strength material can also be utilized. Preferably, the face insert **144** is manufactured of titanium, a titanium alloy, aluminum or an aluminum alloy. The use of an insert **144** allows more weight to be distributed at the periphery of the head, thus increasing the moment of inertia of the head around a vertical and/or horizontal axis through the center of gravity. The insert also allows the strike face area to be increased for a given club head weight. The main body **77** of the head **76***a* is preferably manufactured of steel or a steel alloy.

FIG. **13** is a rear view of another embodiment of the golf club head **108***a* from the third group **36**. In this embodiment, the golf club head **108***a* does not include a rear cavity. Rather, the golf club head **108***a* is a blade-shaped iron head. The club head **108***a* comprises a unitary body having a flat strike surface **124** and a rear surface **128** opposed thereto. Preferably, the club head has a thickness T_2 from the strike surface **124** to the rear surface **128**. The distribution of the thickness T_2 is preferably selected to concentrate more mass in a central region behind the strike surface **124**. As best shown in FIG. **14**, the thickness T_2 is greater behind the point where the ball should impact the strike surface **124** to provide a more solid shot and increase the precision of the club head **108***a*. The thickness T_2 gradually decreases or becomes constant moving upward toward the upper portion **112** so that the thickness T_2 is lowest at an upper edge.

With reference to FIG. **15**, an alternative embodiment of the set **30** of irons includes thirteen irons that are divided into four groups including a first group **156**, a second group **158**, a third group **160** and a fourth group **162**. In the illustrated embodiment, the first group **156** includes the 1, 2, 3, and 4 irons, the second group **158** includes the 5 and 6 irons, the third group **160** includes the 7, 8, and 9 irons and the pitching wedge (PW), and the fourth group **162** includes the gap or approach wedge (AW), the sand wedge (SW), and the lob wedge (LW). The distribution of the irons within the groups could be varied, although each iron of the alternative embodiment is preferably within only one of the groups **156**, **158**, **160**, and **162**. The particular club heads used in the groups shown in FIG. **15** are one specific example and could be varied.

In another embodiment, the first group **156** includes the 1–4 irons, the 1–5 irons, or the 1–6 irons. The second group **158** includes the next clubs in sequence after the last club from the first group, up to the 6, 7, or 8 iron. The third group **160** includes the next clubs in sequence after the last club in the second group **158**, up to the pitching wedge. The fourth group **162** includes the approach wedge, the sand wedge, and the lob wedge. Alternatively, the alternative embodiment of the set **30** could include 3 groups wherein a first group includes the 1–4, 1–5, or 1–6 irons, the second group includes the next clubs in sequence after the last club in the first group up to the 9 iron or pitching wedge, and the third group includes the next clubs in sequence after the last club in the third group up to the lob wedge.

With reference to FIGS. **16** and **17**, there is shown an exemplary club head **38***b* from the first group **156**. The club head **38***b* has the same general structure as the club head **38** described above with respect to FIGS. **2** and **3**. However, the club head **38***b* includes a uniquely-shaped weight insert **170** attached to the main body **40**, as described more fully below. For convenience, like reference numerals will be used between like parts of the club heads **38** and **38***b*.

The weight insert **170** extends entirely across the main body **40** from the heel portion **46** to the toe portion **50** and downwardly to the sole **44**. The weight insert **170** has a substantially straight upper edge **172** that is positioned below the rear cavity **60**. The weight insert **170** is thus

positioned entirely below the rear cavity **60** and does not form any part of the annular surface **63** that surrounds the rear cavity **60**.

FIGS. **18** and **19** show another embodiment of the club head **38***b*. In this embodiment, the weight insert **170** does not extend entirely from the heel portion **46** to the toe portion **50**, but rather occupies a more central region therebetween. The entire weight insert **170** is positioned below the rear cavity **60**. As best shown in FIG. **19**, the weight insert **170** of this embodiment is mounted within an internal cavity in the club head **38***b* so that the weight insert **170** is only visible from the sole **44** of the club head **38***b*.

The main body **40** of the club head **38***b* is desirably manufactured of a strong, lightweight material, such as titanium or of a titanium alloy, aluminum or an aluminum alloy. The weight insert **170** is desirably manufactured of a heavier material than the main body **40**, such as tungsten alloy. The use of light-weight titanium or aluminum is highly suited for the long irons of the first group **156**. The weight savings provided through the use of titanium or aluminum allows the club head **38***b* to be made larger and increase the size of the sweet spot. The weight insert **170** advantageously lowers the position of the center of gravity of the club head **38***b*, as described in more detail below.

The position of the weight insert **170** provides certain advantages. The low position relative to the rear cavity **60** facilitates manufacturing of the club head **38***b*. Because the weight insert **170** does not break into the annular surface **63** surrounding the rear cavity **60**, the weight insert does not have to be shaped to match the shape of the annular surface **63**. This eliminates additional finishing processes that are often necessary to smoothly blend the juncture between the weight insert and the annular surface surrounding the rear cavity in cases where the weight insert breaks into the annular surface.

With reference to FIGS. **20** and **21**, there is shown an exemplary club head **76***b* from the second group **158**. The club head **76***b* has the same general structure as the club head **76***a* as described above with respect to FIGS. **10** and **11**. Thus, like reference numerals will be used between like parts of the club heads **76***a* and **76***b*. As best shown in FIG. **20**, the club head **76***b* includes a first weight insert **174** and a second weight insert **176** that are attached to the main body **77** of the club head **76***b*. The first weight insert **174** is positioned below the rear cavity **94** near the heel portion **80** of the club head **76***b*. The second weight insert **176** is positioned near the toe portion **82** such that it has a shape and position that preferably mirrors the shape and position of the weight insert **174**.

In another embodiment of the club head **76***b* shown in FIG. **22**, the weight inserts **174** and **176** are replaced by a single weight insert **178** that extends from the heel portion **80** to the toe portion **82** of the club head **76***b*. The weight insert **178** or weight inserts **174** and **176** could also be mounted within a cavity in the club head **76***b*, such as was described above with respect to the club head **38***b* shown in FIGS. **18** and **19**.

With reference to FIG. **21**, the club head **76***b* could also include a face insert **144** that is attached to the front side **86** of the main body **77** of the club head **76***b*. The face insert **144** forms the strike surface **90** of the club head **76***b*. The club head **76***b* could be equipped with any combination of the face insert **144** and the weight inserts **174**, **176**, or **180** on the main body **77**.

The main body **77** of the club head **76***b* is desirably manufactured of a hard material, such as steel. The face insert **144** is desirably manufactured of a stronger and/or lighter material than the main body **77**, such as titanium or aluminum, and the weight inserts **174** and **176** (or the weight insert **178**) are desirably manufactured of a higher density material than the main body **77**, such as a tungsten alloy. The use of a face insert **144** enhances perimeter weighting. Additionally, light-weight face inserts reduce the amount of weight consumed in the region of the strike surface **90**. The weight savings allows more mass to be used in the periphery of the club head **76***b* to thereby increase the stability of the club head **76** for off-centered shots. Because the relatively high-priced titanium or aluminum is only used for the face insert **144**, the cost of the club head **76***b* is lower than if the entire club head **76***b* were manufactured of titanium or aluminum.

With reference to FIGS. **23–25**, there is shown an exemplary club head **108***b* from the third group **160**. The club head **108***b* has the same structure of the club head **108** as described above with respect to FIGS. **6** and **7**. Thus, like reference numerals will be used between like parts of the club heads **108** and **108***b*. As mentioned above with respect to FIG. **7**, the club head **108***b* includes a bulged or thick portion **138** (FIG. **25**) immediately behind the theoretical point of impact of the strike surface **124** on the ball. The thick portion **138** could be eliminated on the lower numbered clubs so that the rear surface **131** of the rear cavity **130** is substantially flat, such as shown in FIG. **24**. It is contemplated that the thickness between the rear surface **131** on the rear cavity **130** and the strike surface **124** could gradually increase moving from the lower-numbered to the higher-numbered irons of the third group **160** so that the size of the thick portion **138** also gradually increases. The club head **108***b* is desirably manufactured of steel.

FIGS. **26** and **27** show an exemplary club head **180** from the fourth group **162**. The club head **180** is a blade-type club head having a unitary main body **182** that includes a flat strike surface **184** and a rear surface **186** opposed thereto. The distribution of the thickness between the strike surface **184** and the rear surface **186** is preferably selected to concentrate more mass in a central region behind the strike surface **184**, preferably immediately behind the theoretical point of impact with a golf ball. This provides a more solid shot and increases the controllability of the ball when hit by the club head **180**. This is highly desirable for the wedge-type irons that comprise the fourth group **162**. The club head **180** is desirably manufactured of forged or cast steel.

FIG. **28** shows a general feature which may be common to all of the club heads in the first, second, and third groups **132**, **134**, and **136**, respectively. The strike surface (referred to generally using reference numeral **142**) of each of the clubs in the set **30** may increase progressively in size from the shorter clubs to the longer clubs (i.e., from the sand wedge to the number 2 club). Advantageously, the increase in the size of the strike surface **142** provides a gradual increase in the size of the sweet spot. The greater sweet spot size increases the likelihood of a desirable result even on off-centered shots. The larger size of the sweet spot for the long irons thus increases the golfer's confidence and contributes to the important psychological aspects of the game. Alternatively, the size of the strike surface of the irons in the set **30** could remain substantially constant.

With reference to FIG. **28**, the strike surface **142** desirably has predetermined indicia or markings that are identical for all of the clubs in the set **30** to identify the clubs as being part of the set **30**. For example, the strike surface could include a predetermined pattern of grooves **144**. The strike surface **142** could also include a left and right border lines **146** and

148. The area within the border lines **146** and **148** could be a different color than the rest of the club head to highlight the strike surface **142**. Alternately, a single border line could surround the strike surface **142**, such as is shown in FIG. **12**.

If desired, the number of groups within the set **30** or the distribution of the irons within the groups may be varied. For example, in another embodiment, the set **30** may comprise two groups of clubs wherein the first group includes the 1, 2, 3, 4, 5, and 6 irons and the second group comprises the 7, 8, and 9 irons and the pitching wedge. The clubs that make up each group could also be varied. For example, the first group could comprises the 1, 2, 3, and 4 irons and the second group could comprise the 5, 6, 7, 8, and 9 irons and the pitching wedge. As mentioned, for a given set **30** of irons, each club is part of only a single group.

The aforementioned structures of the club heads in the set **30** result in a unique trend regarding the vertical positions of the centers of gravity of the club heads in the set **30**. That is, preferably, the vertical positions of the centers of gravity generally rise or at least remain steady relative to the bottom or sole of the clubs moving from the lower-numbered clubs to the higher-numbered clubs. With reference to FIGS. **30** and **30A**, the vertical position of the center of gravity CG of an exemplary club head **200** from the set **30** is described with reference to the vertical position D of the center of gravity CG relative to a ground plane P. The club head **200** has a hosel **201**, a front face **202** and a strike portion **204** thereon. The strike portion **204** contains grooves **205**. A forward lower edge **206** connects the front face **202** with the sole **208** of the club head **200**. The vertical position D of the center of gravity CG is the vertical distance between the center of gravity CG and a ground plane P when the club head **200** is oriented at the address position with the grooves **205** parallel to the ground plane P and the axis B of the hosel **201** contained in a plane perpendicular to the ground plane P.

FIG. **31** is a graph of the vertical positions of the centers of gravity of the clubs within the set **30**. As shown, in one embodiment, referred to as embodiment A, preferably, the vertical positions of the centers of gravity generally rise moving from the number 1 iron to the pitching wedge. The vertical position D of the center of gravity of the clubs heads for embodiment A are as follows.

The vertical position D of the CG for the 1 iron may be from approximately 0.500–0.740 inches, preferably from approximately 0.610–0.650 inches, and is more preferably approximately 0.630 inches. The vertical position D of the CG for the 2 iron may be from approximately 0.500–0.740 inches, preferably from approximately 0.615–0.655 inches, and is more preferably approximately 0.635 inches. The vertical position D of the CG for the 3 iron may be from approximately 0.510–0.730 inches, preferably from approximately 0.620–0.660 inches, and more preferably is approximately 0.640 inches. The vertical position D of the CG for the 4 iron may be from approximately 0.510–0.730 inches, preferably from approximately 0.640–0.680 inches, and more preferably is approximately 0.660 inches. The vertical position D of the CG for the 5 iron may be from approximately 0.520–0.750 inches, preferably from approximately 0.660–0.700, and more preferably is approximately 0.680 inches. The vertical position D of the CG for the 6 iron may be from approximately 0.520–0.750 inches, preferably from approximately 0.680–0.720, and more preferably is approximately 0.700 inches. The vertical position D of the CG for the 7 iron may be from approximately 0.600–0.750 inches, preferably from approximately 0.685–0.725, and more preferably is approximately 0.705 inches. The vertical position D of the CG for the 8 iron may be from approximately 0.600–0.750 inches, preferably from approximately 0.690–0.730, and more preferably is approximately 0.710 inches. The vertical position D of the CG for the 9 iron may be from approximately 0.620–0.740 inches, preferably from approximately 0.695–0.735, and more preferably is approximately 0.715 inches. The vertical position D of the CG for the pitching wedge may be from approximately 0.620–0.740 inches, preferably from approximately 0.700–0.740, and more preferably is approximately 0.720 inches.

In another embodiment, referred to as embodiment B, preferably, the vertical positions of the centers of gravity generally rise from the number 1 iron to approximately the number 7 or 8 iron. The vertical positions then remain generally steady for the rest of the irons. The vertical position D of the center of gravity of the clubs heads for embodiment B are as follows.

The vertical position D of the CG for the 1 iron may be from approximately 0.500–0.740 inches, preferably from approximately 0.610–0.650 inches, and is more preferably approximately 0.630 inches. The vertical position D of the CG for the 2 iron may be from approximately 0.500–0.740 inches, preferably from approximately 0.615–0.655 inches, and is more preferably approximately 0.635 inches. The vertical position D of the CG for the 3 iron may be from approximately 0.510–0.730 inches, preferably from approximately 0.620–0.660 inches, and more preferably is approximately 0.640 inches. The vertical position D of the CG for the 4 iron may be from approximately 0.510–0.730 inches, preferably from approximately 0.640–0.680 inches, and more preferably is approximately 0.660 inches. The vertical position D of the CG for the 5 iron may be from approximately 0.520–0.750 inches, preferably from approximately 0.660–0.700, and more preferably is approximately 0.680 inches. The vertical position D of the CG for the 6 iron may be from approximately 0.520–0.750 inches, preferably from approximately 0.670–0.710, and more preferably is approximately 0.690 inches. The vertical position D of the CG for the 7 iron may be from approximately 0.600–0.750 inches, preferably from approximately 0.680–0.720, and more preferably is approximately 0.700 inches. The vertical position D of the CG for the 8 iron may be from approximately 0.600–0.750 inches, preferably from approximately 0.680–0.720, and more preferably is approximately 0.700 inches. The vertical position D of the CG for the 9 iron may be from approximately 0.620–0.740 inches, preferably from approximately 0.680–0.720, and more preferably is approximately 0.700 inches. The vertical position D of the CG for the pitching wedge may be from approximately 0.620–0.740 inches, preferably from approximately 0.680–0.720, and more preferably is approximately 0.700 inches.

In contrast, in a conventional set of irons the vertical positions of the centers of gravity gradually lowers moving from the lower numbered to the higher numbered clubs.

Certain advantages are associated with the aforementioned distribution of the centers of gravity of the clubs in the set **30**. As mentioned, the low center of gravity of the long irons makes it easier for a golfer to get the ball airborne. The higher position of the center of gravity for the shorter irons reduces the likelihood of the shorter irons producing an overly high trajectory. The aforementioned club head structures provide advantages that are not present in a conventional set of irons.

Additional club head designs are disclosed in the following related patent applications, which are hereby incorpo-

rated by reference in their entirety: U.S. patent application Ser. No. 08/787,113, filed on Jan. 22, 1997, which is a continuation-in-part of U.S. patent application Ser. No. 08/711,267, filed on Sep. 9, 1996, which claims priority to U.S. Provisional Application Ser. No. 60/023,257, filed on Aug. 9, 1996.

Although the foregoing description of the preferred embodiment of the preferred invention has shown, described, and pointed out certain novel features of the invention, it will be understood that various omissions, substitutions, and changes in the form of the detail of the apparatus as illustrated as well as the uses thereof, may be made by those skilled in the art without departing from the spirit of the present invention. Consequently, the scope of the present invention should not be limited by the foregoing discussion, which is intended to illustrate rather than limit the scope of the invention.

What is claimed is:

1. A correlated set of golf clubs comprising:

a first group of golf clubs comprising a plurality of clubs wherein each of said golf clubs has a head and a loft designation and at least one such club is designated 3, wherein each of the clubs in said first group comprises a club head having a main body of a first material having a first density, a face, a sole, a rear cavity surrounded by a peripheral belt of mass, a separate weight insert having a density higher than said main body and positioned at a lower portion of said peripheral belt of mass, and each club head having a first center of gravity located a first vertical distance from a ground plane when said head is in address position;

a second group of golf clubs comprising a plurality of clubs wherein each of said golf clubs has a head and a loft designation higher than said loft designations of said first group and at least one such club is designated 6, wherein each of the clubs in said second group comprises a club head having a main body of a material having a second density that is higher than said first density, a face, a sole, a rear cavity surrounded by a peripheral belt of mass, a separate weight insert having a density higher than said main body and positioned at a lower portion of said peripheral belt of mass, and each club head having a second center of gravity located a second vertical distance from the ground plane when said head is in address position, said second vertical distance being longer than said first vertical distance;

a third group of golf clubs, wherein each of the clubs in said third group comprises a club head having, a main body of a material having a density higher than said first density, each of said third group of golf clubs having a head and a loft designation designating a higher loft than said second group, and each club having a third center of gravity located a third vertical distance from the ground plane when said head is in address position, said third vertical distance being at least equal to or longer than said second vertical distance, and said club head of each of the clubs in said third group being without a separate weight insert having a density higher than said density of its main body.

2. The correlated set of golf clubs of claim 1, wherein said first material comprises one of titanium and a titanium alloy, and wherein said weight inserts of the first set of clubs are made of tungsten with a density greater than 10 grams per cubic centimeter.

3. The correlated set of golf clubs of claim 2, wherein said second material comprises one of steel, a steel alloy, copper, a copper alloy, nickel, and a nickel alloy, and wherein said weight inserts of the second set of clubs are made of tungsten with a density greater than 10 grams per cubic centimeter.

4. The correlated set of golf clubs of claim 1, wherein said weight inserts of said club heads of said first and second group are positioned entirely below an annular surface surrounding said rear cavities of said club heads of said first and second groups.

5. The correlated set of golf clubs of claim 4, wherein said weight inserts of said club heads of said second group comprise two distinct weights located symmetrically about a vertical axis that passes through said second center of gravity.

6. The correlated set of golf clubs of claim 1, wherein each of the clubs in said third group additionally comprises a face, a sole, and a rear cavity surrounded by a peripheral belt of mass, and wherein a thickness between the rear surface on the rear cavity and the face increases as the head and loft designation increases.

7. The correlated set of golf clubs of claim 1, wherein the faces of the club heads of the first group are larger than the faces of the club heads of the second group.

* * * * *